

# SOLID FREEFORM FABRICATION



Solid Freeform Fabrication (SFF) offers unique capabilities in fabricating complex three-dimensional objects. Prototype fabrication of models or functional objects is done via Laminated Object Manufacturing (LOM). The cutting of the material of the prototype is done with a 50watt CO<sub>2</sub> laser that has a beam diameter of 200mm and can cut at speeds up to 50cm/s. Lamination of the material is done via a hot compression roller that reaches material temperatures of 120°C. The commercial material is high strength laminated paper or plastic. The LOM process starts with a stereolithography (STL) computer file of the object to be built. The LOM computer segments the object into slices into segments the thickness of the laminating material and calculates a 2-D design for each slice. The object is then built, layer by layer. The first layer is rolled down on a platform table and the laser cuts through the thickness of the material, cutting the pattern for that particular layer and cross-hatching the unwanted material. The platform table is lowered, and the next layer of material is laminated to the build. This process is repeated until the object is completely fabricated. Upon completion it is separated from the platform and the crosshatched excess material is removed yielding the completed prototype. The result is a complex 3-D object that cannot be built as efficiently in any other fashion. Research is being carried out at NRL to adapt the LOM process to fabricate functional ceramic prototypes from green ceramic tapes because of solid freeform's unique capabilities. Using SFF, functional novel object properties can be maximized by coupling 3-D geometric design with controlled spatial (z-axis) material composition. SFF also enables great flexibility in manufacturing functional prototypes of different designs, enabling rapid design verification and prototype development. At NRL, novel telescoping ceramic actuators have been built via SFF. Future plans include fabricating high capacitance ceramic capacitors for Power Electric Building Blocks (PEBB) power supplies and integrated power electronics devices.

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